SOFTWARE ENGINEERING
(CSEN 3202)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which is NOT a non-functional requirement?
(a) Efficiency (b) Reliability
(c) Product features (d) Stability.

(ii) What is typically used to represent some complex processing logic in a tabular or matrix form during requirement analysis?
(a) Decision tree (b) Decision table
(c) Data table (d) CRUD matrix.

(iii) Alpha-testing is done by
(a) the development team (b) a friendly set of customers
(c) the customer himself (d) none of these.

(iv) Which type of DFD has two bubbles directly interconnected through a data flow?
(a) Serial DFD (b) Parallel DFD
(c) Synchronous DFD (d) Asynchronous DFD.

(v) "A class diagram provides the _____ view of a system." – fill in the blank.
(a) user (b) structural
(c) environmental (d) behavioral.

(vi) The cyclomatic complexity of the following program fragment is

```
int gcd (int x, int y) {
   while (x != y) {
      if (x > y) then
         x = x – y;
      else  x = y – x;
   }
   return x;
}
```

(a) 2 (b) 3 (c) 4 (d) 5.

(vii) Which is *not* a size measure for software?
(a) LOC (b) Function count
(c) Cyclomatic complexity (d) Halstead's program length.

(viii) What type of software maintenance will be needed to take care of a Banking system that sometimes produces incorrect Closing Balance values for account holders who make more than three withdrawals during one calendar month?
(a) Corrective (b) Perfective
(c) Preventive (d) Adaptive.

(ix) The 'Slack' (in time units) for an activity on the critical path of a project schedule will be _____.
(a) infinite (b) nil (c) highest (d) lowest.

(x) Which form of software development model is most suited to a system where all the requirements are known at the start of a project and remain stable throughout the project?
(a) Waterfall model (b) Incremental model
(c) Evolutionary model (d) Spiral model.

Group – B

2. (a) What is meant by "Non-functional Requirement" in a Software Requirements Specification (SRS)? Mention ***three*** typical non-functional requirements in an SRS.

(b) Provide examples of ***four*** important functional and non-functional requirements for an internet-based banking system which will allow bona fide account holders to make online transaction for payment through bank transfer within a maximum of 120 seconds any time of the day, either from a desktop / laptop or from a mobile / tab.

(1 + 3) + (4 + 4) = 12

3. (a) Briefly discuss two most popular reasons of adopting Agile model.

(b) Briefly describe one situation when Agile is ***not*** the best choice of development?

(c) What is "Scrum Sprint"?

(d) What do you understand by "Daily Stand-Up" (or "Daily Scrum")?

(e) What is the difference between Waterfall and Agile models?

(2 + 2) + 2 + 2 + 2 + 2 = 12

Group – C

4. (a) Name the different types of views and the corresponding diagrams that are used to describe a system in UML-based modeling.

(b) Represent the following situation using one UML class diagram:
Bill is described by Bill-Number, Bill-Date, and Total-Amount, and must contain one or more Items; each Item is described by its Item-Name, Item-Unit-Price, Item-Quantity, and Item-Price.

7 + 5 = 12

5. (a) Name any ***three*** types of cohesion that modules can have in software design. Grade these three in terms of from 'High' to 'Low'.

(b) Name any ***three*** types of coupling that modules can have in software design. Grade these ***three*** in terms of from 'Low' to High'.

(c) How is control coupling between two modules represented in a Structure Chart (SC)?

(d) Identify and create use cases and actors for the problem statement stated below:
The CSE students and Faculty use the Library System. The Library contains Books and Journals. Books can be issued to both the Students and Faculty. Journals can only be issued to the Faculty. The Librarian can only issue books and Journals. The deputy-Librarian is In-charge of receiving the Returned Books and Journals. Each student is provided with three Library cards for using the facilities of the Library. Students can be issued only three books on their available cards at a time. On the issue of the books the Librarian specifies a date on which the students are expected to return the book. In case they are unable to do so, they will be charged with a fine of Rs.2 per day. The Accountant is responsible for receiving the fine for over-due books. Each Faculty is provided with a Library member ID. Faculties can be issued a maximum of five books at a time. The issue of Journals and Books to the Faculties is also performed in the same manner. Faculties are not charged with any fine.

3 + 3 + 2 + 4 = 12

Group – D

6. (a) Differentiate between each pair below:
(i) Procedural Language and Object Oriented Language

(ii) Code Inspection and Code Walkthrough
(iii) External Documentation and Internal Documentation
(iv) Functional Testing and Structural Testing.

(b) Explain the role of 'Stub' and 'Driver' for Unit Testing of modules.

(4 × 2) + 4 = 12

7. (a) Explain, in brief, 'Equivalence Class Partitioning' and 'Boundary Value Analysis' approaches for testing, with suitable example(s).

(b) Explain, in brief, the concepts of 'Statement Coverage', 'Branch Coverage', 'Condition Coverage' and 'Path Coverage' strategies, with suitable example(s).

(c) Identify the ***three*** equivalence classes for a module that computes the square root of an input integer than can assume values in the range of 1 to 100, both included.

(d) Draw the Control Flow Graph (CFG) and work out the Cyclomatic Complexity (CC) for the following program segment:

```
int find_gcd(int m, int n) {
        while (m != n) {
                if (m > n)
                then m = m – b;
                else n = n – m;
        }
        return m;
}
```

2 + 4 + 3 + 3 = 12

Group – E

8. (a) Define the meaning of software quality and detail the factors which affect the quality and not the productivity of a software product.

(b) Are Software Quality Control and Software Quality Assurance same? Justify your answer.

(c) What is the difference between a revision and a version? What do you understand by the terms change control and version control? Why are these necessary? Explain how change and version control are achieved using a configuration management tool.

(2 + 2) + 2 + (2 + 2 + 2) = 12

9. (a) A project size of 200 KLOC is to be developed. S/W development team has average experience on similar type of projects. The project schedule is not very tight. Calculate the effort and development time of the project.

Project	a_b	b_b	c_b	d_b
Organic	2.4	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

(b) The Reliable Construction Company has just made the winning bid of $5.4 million to construct a new plant for a major manufacturer. The manufacturer needs the plant to go into operation within a year. Therefore, the construction manager, David Perty has prepared a list of the various activities of the project reported in the following table:

TABLE Activity list for the Reliable Construction Co. project

Activity	Activity Description	Immediate Predecessors	Estimated Duration
A	Excavate	—	2 weeks
B	Lay the foundation	A	4 weeks
C	Put up the rough wall	B	10 weeks
D	Put up the roof	C	6 weeks
E	Install the exterior plumbing	C	4 weeks
F	Install the interior plumbing	E	5 weeks
G	Put up the exterior siding	D	7 weeks
H	Do the exterior painting	E, G	9 weeks
I	Do the electrical work	C	7 weeks
J	Put up the wallboard	F, I	8 weeks
K	Install the flooring	J	4 weeks
L	Do the interior painting	J	5 weeks
M	Install the exterior fixtures	H	2 weeks
N	Install the interior fixtures	K, L	6 weeks

For any given activity, its immediate predecessors (as given in the third column of Table) are those activities that must be completed by no later than the starting time of the given activity. (Similarly, the given activity is called an immediate successor of each of its immediate predecessors.)

(i) Prepare a work breakdown structure (WBS) for the activities listed in the above table.

(ii) Based on WBS, draw a Gantt chart of the project schedule.

(iii) Deduce the number of independent paths and path-lengths. Find out the critical path and critical path length.

(1.5 + 1.5) + (4 + 3+ 2) = 12